INSTITUTE OF ADVANCED MATERIALS AND TECHNOLOGY
UNIVERSITY OF WASHINGTON

Director: Alex K-Y. Jen

OVERVIEW

The Institute of Advanced Materials and Technology (*i*-AMT) was established in 2006 to function as a catalyst for achieving excellence in materials research. The Institute emphasizes integrated interdisciplinary research and provides a framework to enhance the impact of cross-cutting UW materials science programs. It strives to achieve this through fundamental research, as well as technology transfer that can generate jobs and economic growth. *i*-AMT seeks to leverage federally funded research by forming collaborations with academic, business, industry and government partners in areas of national interest in order to address, in an agile and coordinated manner, global challenges in areas such as information technology, biotechnology, new energy sources, and nanotechnology.

The impact of materials technology on society has, and will continue to be, enormous:

- Advanced semiconductors have led to high speed computers;
- Optical fibers have dramatically enhanced the bandwidth of communications infrastructure;
- Biomaterials have enhanced the quality and duration of life;
- Magnetic materials have made large scale data storage possible;
- Lightweight metals and advanced composites have made airplanes more fuel efficient;
- Advanced materials in batteries and fuel cells are key to the growing capacity of portable power sources for hand-held devices, hybrid vehicles, and many other systems not connected to an electrical grid.

VISION

To discover, design and develop advanced materials to benefit society.

MISSION

The *i*-AMT will provide leadership to foster excellence in materials research by facilitating the work of faculty and students so as to achieve sustainable solutions to major problems facing society. The Institute will focus on selected areas including photonics, electronics, and magnetic materials; materials for energy generation; biomaterials for the bio-nano interface; and multifunctional composites. The mission includes the following elements.

1. To create a highly flexible and nimble research community that will a) foster the generation and exchange of ideas among a diverse range of investigators on problems of major importance

to society, and b) be responsive to opportunities for innovative research initiatives in an integrated and comprehensive framework.

2. To coordinate the work of selected campus programs and Centers engaged in research in the selected areas to ensure synergy for these UW initiatives.

3. To create an environment that nurtures entrepreneurial researchers and encourages them to be imaginative in translating discovery into products for the marketplace.

4. To foster a high-level and long-term perspective on major problems so as to identify the knowledge gaps, and then to devise strategies that will accelerate the research needed for practical outcomes of value to industry.

5. To serve as an honest broker between the academic and business community to identify strategies that will help translate research discoveries into practical commercial products.

6. To create a shared core instrumentation and service facility that will propel UW materials science and technology-transfer to a recognized leadership position in materials science research.

CORE VALUES

Our values reflect our quest for excellence in materials research through our emphasis on accountability and mutually rewarding partnerships. "We are stronger together than independently." Our values include:

- Working at the intellectual frontiers to achieve excellence in materials research.
- Promoting a global perspective albeit with an emphasis on the national interest.
- Creating mutually rewarding and beneficial partnerships.
- Building a diverse environment that welcomes all colleagues.
- Actively promoting knowledge creation, sharing and transfer.
- Engaging fully in education for emerging and future scientists.
- Being accountable to researchers and partners.
- Advancing economic development for the benefit of society through technology transfer, spin off's and start ups.
- Striving for economic sustainability through community contributions and investments.
- Educating its scientists and post-doctoral fellows for success in an interdisciplinary environment and for the global economy.

OPERATIONAL STRATEGIES

One of the goals of *i*-AMT is to foster high quality, high impact research, and to facilitate the transfer of the knowledge gained so that it benefits society. The Institute will be recognized first and foremost as a research and education program that builds on foundation of discovery and innovation. Thus, it will emphasize fundamental research activities in addition to applied research that seeks to address major societal issues. But above all, the Institute will seek to enhance, coordinate and expand the work on materials across campus, and to make that work available to the public to benefit society.

1. The Institute can serve an important role by convening groups with common interests to brainstorm and identify/explore opportunities in preparation for submission of proposals for new initiatives. When the results of the research are published, the papers should acknowledge the work as products of the Institute.

2. In already established areas on campus such as nanotechnology, composites, and electro-optics, the Institute will seek to work cooperatively to add value and, as appropriate, to coordinate those efforts. In areas such as energy and energy-related materials as well as biophotonics which are less structured at the present time on campus, the Institute will provide leadership to bring these areas into greater prominence and synergy.

3. The Institute will create a shared instrumentation facility.

4. The Institute will create an equipment inventory to expand access to equipment on campus, to use resources more effectively, and to accelerate the rate at which new research directions can be explored and exploited. This inventory would reside on the Institute website and would be developed in stages as resources allow and the response of users would suggest.

5. A synthesis scale-up facility will be available and maybe even a synthesis service center will be developed.

6. Facilitating technology transfer will be a major activity for the Institute. An agreement will be developed with UW Tech Transfer to spell out precisely what the Institute role would be and how it would interface with UW Tech Transfer. The Institute will work with UW Tech Transfer (as well as WTC, WRF and private donors) to create a funding pool to support rapid filing of provisional patents.

7. The Institute's Intellectual Property Advisory Board will advise and facilitate the Institutes work in technology transfer and commercialization. Their role will be to pass judgment on recent

discoveries and emerging technologies to help determine whether and how to pursue further development, ip protection or start-up funding. This group would also enhance communications with the investment/business community, and work to bring the fruits of the research enterprise to the marketplace.

RESOURCES TO SUPPORT RESEARCH

Since one of the primary goals of *i*-AMT is to integrate the vibrant but fragmented materials research at UW and transfer the developing technologies to the commercial sector, it is critical for the Institute to establish an efficient and functional shared instrumentation and service facility to expedite such developments. We will capitalize on an extensive infrastructure already in place or being established at UW to provide state-of-the-art instrumentation support for Institute researchers and industry participants.

Shared Optoelectronic Device Test Facility: A world-class optoelectronic device testing facility has been proposed through the Murdock Charitable Trust to support the new silicon photonics effort, and to complement the existing world-class materials synthesis and characterization efforts on campus. ***This facility will have two primary functions: First, to provide comprehensive test capabilities for nanoscale silicon and hybrid silicon/polymer photonic devices***. Such devices provide a unique path for the revolutionary polymer photonic materials being developed at the UW. The goal is to demonstrate that these ideas can be turned into commercially viable working devices. ***The second function is to provide flexible testing capabilities for a wide variety of optoelectronic devices in other material systems and geometries, in order to lower the barriers to entry into optoelectronics projects across the entire campus.*** The facility will be accessible to users from off-campus, such as local companies, in order to spur academic/industrial collaborations as well as commercialization of university technologies.

In addition, an undergraduate teaching lab has been proposed in association with the research facilities, in order to give undergraduates the opportunity to learn critical skills needed for successful participation in the optical device research.

Facility for Synthetic Scale-up and Purification: For many biological, optical, and electronic studies being carried out by the researchers in the Institute and by the industrial partners, reasonably large quantities of materials with high purity are required. Most academic laboratories lack the necessary scale-up equipment. A multi-users facility (500 ft^2) for synthetic scale-up and purification will be established at the Hall Building to provide synthetic capabilities for production of new materials in multi-gram or multi-liter amounts and with purity compatible with device fabrication or coating purposes. Through well-coordinated and efficient operation of this facility, materials will be produced and supplied to a number of collaborators within the Institute, as well as government labs and industrial partners to facilitate technology transfer.

Inert Atmosphere System for Fabrication and Characterization of Thin-Film Organic Electronics and Photonics: Two tandem inert atmosphere glovebox systems equipped with a sophisticated evaporator system and state-of-the-art electronic testing equipment will be

established through the Department of Defense and the Murdock Charitable Trust. This facility will allow researchers at the University of Washington to make significant contributions to many areas of organic electronics, electro-optics and surface science.

The resulting fabrication and testing facility will be maintained by staff from the *i*-AMT who will be trained by the manufacturers in equipment use and maintenance. Additionally, the staff member will be responsible for general training in the facility. This lab will be implemented as a cost-per-use basis to provide for long-term sustainability.

Electron Beam Lithography Facilities: Electron beam lithography (EBL) is a fundamental technique for fabricating nanostructures on the 10 nm (~100 atom) scale, and is a key enabler for research in nearly all fields of nanoscience. This capability is essential for creating the next generations of nanoscale devices and systems; no other technology provides the same combination of high resolution, flexibility, and speed as EBL. In fact, a modern electron beam lithography tool is the most flexible, capable, cost-effective research tool for building nanostructures. Such a tool can be used both for single-layer and three dimensional device fabrication since it is capable of overlaying multiple layers with only a few nanometers of position error.

The researchers in *i*-AMT are working to raise funding for purchasing a high throughput EBL tool to enable the integration of the UW's world-leading photonic materials capabilities with novel design of nanoscale devices, for next-generation information technology. The tools commonly available in the academic community are generally only 1/1,000th as fast as the tool that is being pursued, and are only capable of writing nanostructures over sub-millimeter areas. By contrast, the new tool will be capable of writing sub-20 nm structures across entire 6'' diameter wafers, enabling researchers to build integrated nanoscale systems, rather than individual devices.

INTELLECTUAL PROPERTY MANAGEMENT

It is well-known in technology transfer circles that the biggest single source of licensees for university technology is the inventors themselves. Inventors generally have a good idea of at least a few applications for the technology they are helping to develop. Personal contacts, sponsored research collaborations, former students, presentations at conferences, publications and routine inquiries from industry all serve as high-potential sources for identifying licensees. In addition, start-ups spun off from universities frequently involve one or more students or post-docs, with the faculty person in an advisory role.

Facilitating start-ups requires nurturing of technologists who want to start a company, and several resources are available at the UW and in the Seattle area to provide this assistance. In addition to UW TechTransfer, we also have the UW Business School's Center for Innovation and Entrepreneurship and their business plan competition, the Gates Fellows Program, Northwest Entrepreneur Network and the MIT Forum. Contacts with the investment community can be made through interaction with the Alliance of Angels and other angel networks, and through personal contacts with the venture capital community. In addition, the Washington Technology Center also provides an important resource for connecting faculty with potential

commercial interests. We briefly highlight the key strengths of UW Tech Transfer and WTC below.

UW TechTransfer: TechTransfer's primary role is to manage technology resulting from UW research; more specifically, to determine commercial potential, obtain patent protection when justified, identify potential licensees, negotiate license agreements, and oversee university-licensee relations.

Washington Technology Center (WTC): The WTC is a State-supported science and technology center whose mission is to foster economic growth in Washington's technology-based industry sectors. Advanced materials have been one of its cornerstone technology focus areas since its inception in 1983. In addition, the WTC operates the Microfabrication Lab in a 15,000 $ft.^2$ cleanroom facility available to academic and industrial users for a wide range of MEMS and nanoscale processing activities. The Microfab Lab provides researchers with tools for deposition, patterning and packaging of structures and devices employing advanced materials. The Microfab Lab is adjacent to the UW's Center for Nanotechology User Facility, and provides complementary capabilities.

The WTC can serve as a gateway into industrial contacts, with the caveat that its activities are focused on companies (and universities) within Washington State. Perhaps more importantly, the WTC is a funding source for collaborative R&D projects between industry and university researchers, again with the geographic 'Washington State' limitation.

i-AMT's Role in IP Management: The i-AMT will serve as a clearing house for inventions developed by faculty operating under the Institute's umbrella. In this role, i-AMT will perform an initial assessment of the commercial potential, the market, prospective licensees, and the justification for seeking patent protection. This evaluation will be done by the Institute's Intellectual Property Advisory Board which is composed of several seasoned technology business professionals, a representative from the investment community, a technology manger from UW TechTransfer, and the IP and Industrial Agreements Manager, among others. Their recommendations will be forwarded to UW TechTransfer to facilitate and expedite patenting decisions and to initiate licensing discussions.